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(54) **Safety device for sectional overhead doors**

(57) In counterbalance means for a sectional overhead door (1) safety means is provided to operate in the event of failure of a cable (5) of the counterbalance means, the safety means comprising a cam (17) biassed by a spring (22) into a position in which it will brake closing movement of the door, an arm (20) extending radially from a shaft (15) which mounts the cam (17), a gate lever (23) to secure the arm (20) and trip means in the form of a pin (26), coupled to the end of the cable (5), and a spring (10) whereby upon failure of the cable (5) the spring (10) removes the pin (26) to cause the spring (22) to move the cam (17) to effect braking of the closing movement of the door (1).

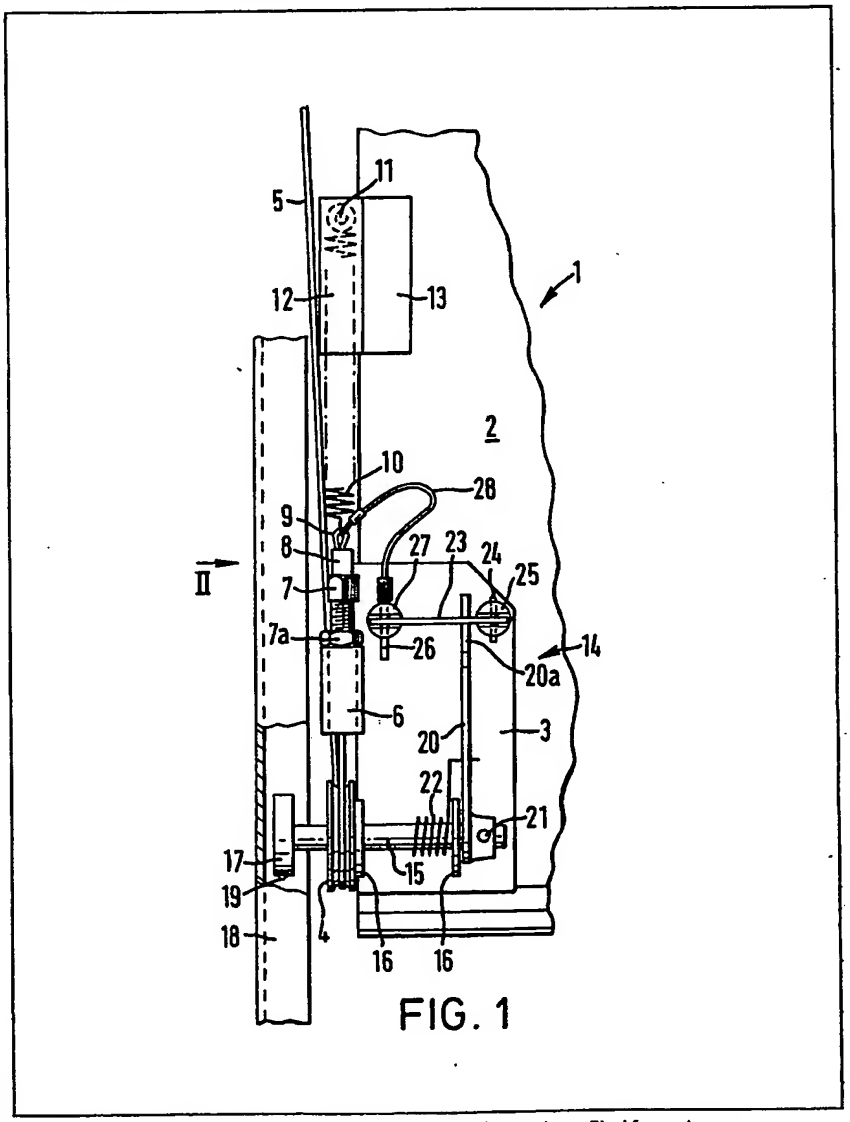

FIG. 1

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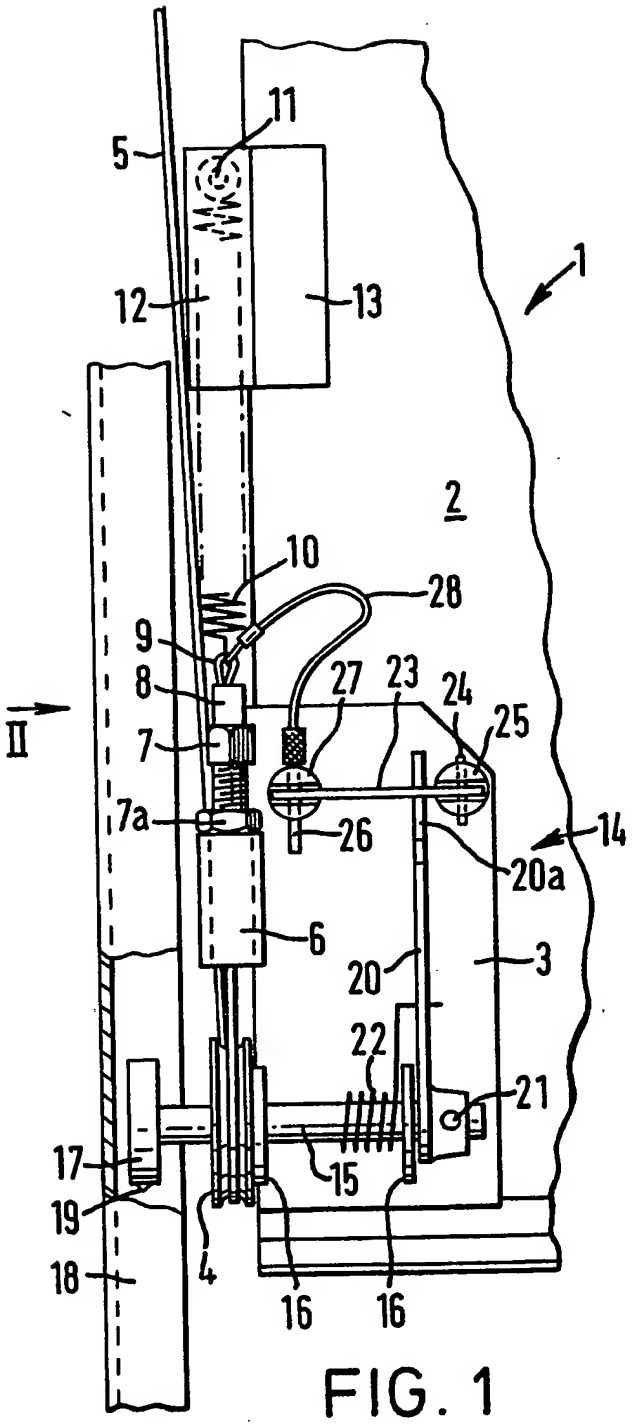
The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.


11
5
1
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10
28
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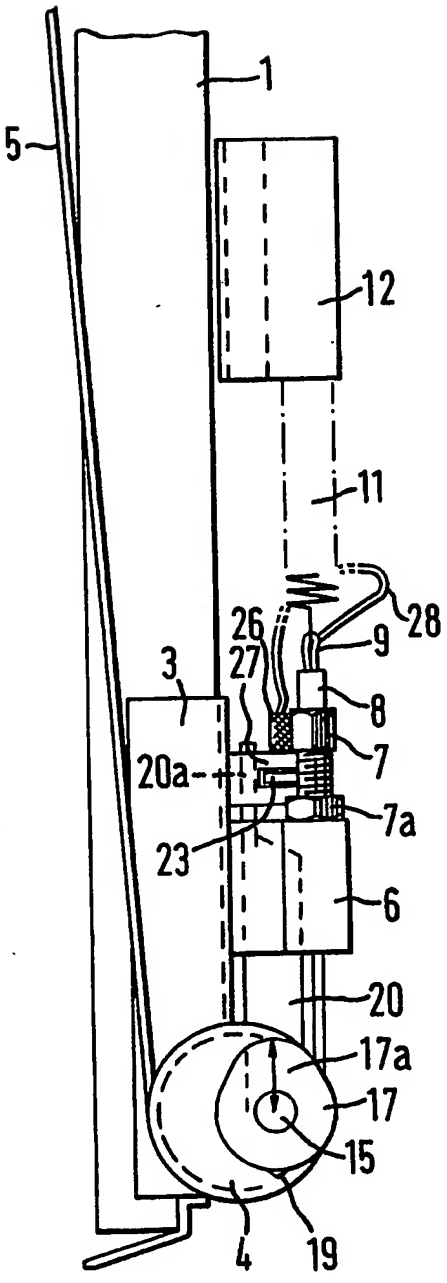
8
27
23
24
25
II
7
7a
26
14
20a
6
20
3
22
21
17
15
19
18
4
16
16

FIG. 1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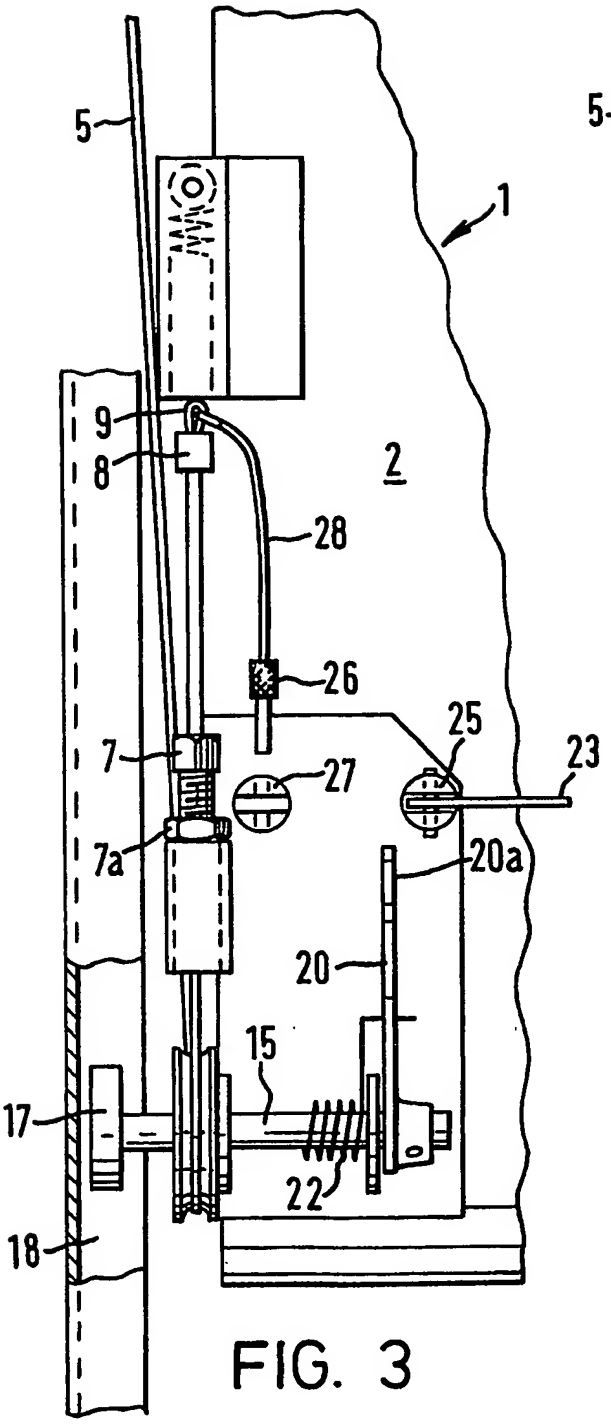
19

FIG. 2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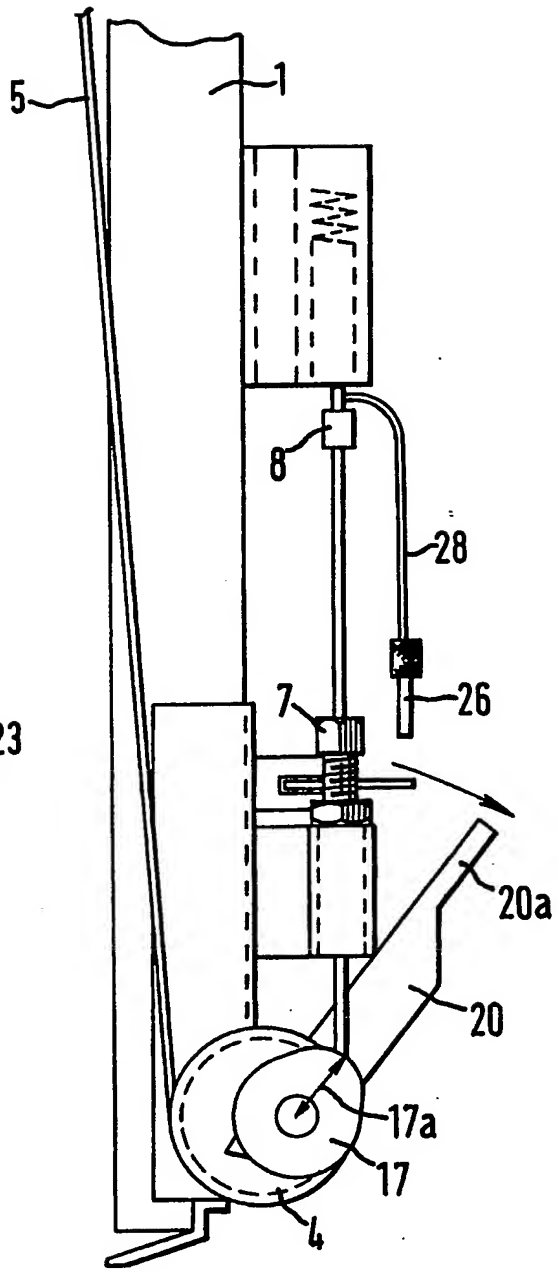
22
18

FIG. 3


5
1
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26
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20
17a
17
4

FIG. 4

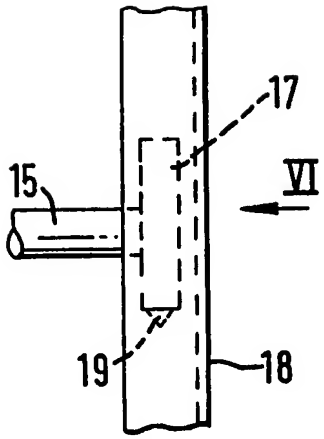

FIG. 5

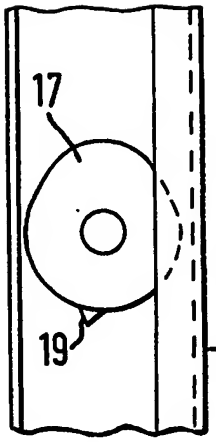

FIG. 6

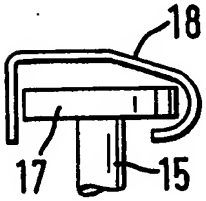

FIG. 7

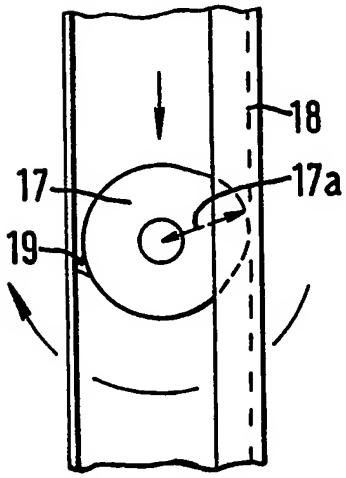

FIG. 8

SPECIFICATION

Safety device for sectional overhead doors

The invention relates to sectional overhead doors such as are widely used for example to close doorways in factories and large garages to allow passage when the door is in an open position of large vehicles.

Such doors generally comprise a plurality of horizontally extending sections hinged to one another about horizontal hinge axes with the outer ends of the sections guided in guides. In the closed position the sections all lie in a common vertical plane and in an open position the sections may lie in a common horizontal plane, a common inclined plane or even a common vertical plane depending upon the vertical spacing between the top of the doorway and the ceiling of the building.

A spring-loaded shaft is normally provided to counterbalance the weight of the door and mounts cable pulleys, normally one for each side of the door, the cable pulleys having cables connected to the lower ends of the door, usually at the sides thereof. Opening and closing means for the door comprise means to rotate the shaft to wind in the cables and may be motor powered or hand operated, in the latter case a chain wheel is provided at one end of the shaft with a continuous chain passing thereover, one or other of the sides of the loop of chain being pulled downwardly to rotate the chain wheel and thus the shaft to reel in or pay out the cables and thus open or close the door respectively.

Our Patent 1 431 473 describes and claims counterbalance means for a sectional overhead door including resilient means to bias a stop on the end of the cable, or each of the cables, away from a cooperating guide for the cable, thereby to ensure that the cable is maintained under tension at all times so that slackness in the cable will not allow the cable to spring off an end of the cable pulley.

Sectional doors of the kind referred to are generally of considerable weight and in the event of failure of a cable could cause considerable damage or injury if cable failure occurred while the door was in an open position. Cables of a strength which considerably exceeds the forces to which they are likely to be subjected in use are normally used but the strength of a cable can be drastically reduced if it is bent with a small radius of bend or if it is kinked or nicked by impact.

Several devices have been proposed to brake the closing motion of a door in the event of cable failure, such devices normally sensing cable tension and in the absence of such tension locking the door against further movement by means of a blade, arcuate toothed member or cam which is biassed for movement to cause braking of the door and is held against such movement by the tension in the cable in normal operation. Such devices however have not proved entirely satisfactory since, as explained in the specification of our Patent 1 431 473, cable slackness without cable breakage can occur in operation, particularly upon initial movement of the door from a fully open position, and such cable slackness can cause operation of the safety braking devices even though cable breakage has not occurred. Some of such devices have the disadvantage also that they are liable to increase the likelihood of cable breakage since a cable guide on a spring-loaded arm through which the cable passes so that its tension is sensed can cause kinking of the cable.

Provision of a safety braking device which may not function correctly in the event of cable breakage can create a worse situation than not providing a safety device at all and any safety braking device must be able to react very quickly since the weight of the door will cause the door to have considerable kinetic energy if it is not braked to a standstill very quickly after it starts to free-fall.

The operation of the previously proposed safety devices has been very difficult to check since such operation normally involves disconnection of the lower end of the cable from its anchorage on the door to simulate cable breakage.

According to the invention, a safety device, to brake closing movement of a sectional overhead door in the event of failure of a cable of counterbalance means for the door, comprises a cam member mounted on a shaft adjacent the lower end of the door and engaged in a guide track for the door, the shaft being spring biassed for rotation so as to rotate the cam member to cause it to bear against the guide track to brake closing movement of the door, an arm secured to the shaft and extending generally radially therefrom, securing means to retain the arm in a first position which corresponds to an inoperative position of the cam member and trip means to disable the securing means in the event of failure of the cable.

Preferably the securing means comprises a gate lever pivoted at one of its ends on the door, extending across the path of movement of the arm from said first position and retained at its other end by a sliding pin. Upon cable failure, the sliding pin is removed by the trip means and the gate lever pivots out of the path of the arm to allow the arm to move from said first position to rotate the cam member and cause it to brake movement of the door. Operation of the safety device can readily be tested by manually removing the sliding pin.

Advantageously the trip means to remove the sliding pin upon cable failure comprises flexible means, such as a wire, chain or cord, connecting the sliding pin to a stop provided at the end of the cable, which stop is biassed away from a guide for the cable, in the manner described in the specification of our Patent 1 431 473, by spring means so that in the event of cable failure, the stop will move away from the guide and cause the flexible means to remove the sliding pin.

It will be seen that the safety device need not exert any lateral force on the cable during normal operation and kinking of the cable by application of such a lateral force is thereby avoided.

Preferably, but not necessarily, the shaft extends through a lower pulley of the door, around which lower pulley the cable passes to extend through the guide to the stop.

The invention is diagrammatically illustrated by

way of example in the accompanying drawings, in which:-

Figure 1 is an elevation of a safety device according to the invention provided at the lower end of a sectional overhead door and on the inner face thereof;

Figure 2 is a side view taken in the direction of arrow II of Figure 1 but with a guide track removed;

Figure 3 is a view corresponding to Figure 1 after tripping of securing means;

Figure 4 is a view similar to Figure 2 but corresponding to the position of Figure 3;

Figure 5 is a rear elevation showing the mounting of a cam member in a guide track;

Figure 6 is a view taken in the direction of arrow VI of Figure 5;

Figure 7 is a plan view corresponding to Figure 6; and

Figure 8 is a view corresponding to Figure 6 but showing the cam member in the position adopted after operation of the safety device.

Referring to the drawings a sectional overhead door 1 has, mounted on its inner face 2, a plate 3 mounting a fixed pulley 4. A cable 5 extends from spring biassed counterbalance means (not shown) downwardly, around the fixed pulley 4, upwardly through a tubular guide 6 secured to the plate 3 and through an adjusting tube 7 with a nut 7*a* to a stop 8, the cable advantageously being doubled back on itself at the position of the stop 8 to form a loop 9. A spring 10 is secured to the loop 9 at its lower end and at its upper end to an ancorage 11 on the door 1, a part of the length of the spring being housed in a square-section guide 12 secured to the face 2 of the door by a projecting flange 13. In the event of any slackness in the cable 5, the force of the spring 10 moves the stop 8 away from the upper end of the tube 7 to tension the cable and prevent it from jumping off cable pulleys provided in the spring biassed counterbalance means (not shown). Equal tension in the cable 5 and in a further similar cable (not shown) at the other side of the door can be obtained by adjusting the position of the nut 7*a* on the tube 7. The above described apparatus is the subject of the specification of our Patent 1 431 473.

To prevent uncontrolled downward movement of the door 1 in the event of failure of the cable 5, a safety device generally indicated at 14 is provided. A shaft 15 is rotatably mounted in spaced bearing supports 16 on the plate 3 and passes through the fixed pulley 4. A cam member 17 is secured at the free end of the shaft 15. The cam member 17 is engaged in a guideway 18 and in the position shown in Figures 1, 2, 5, 6 and 7 is a sliding fit in the guideway 18 such that the door 1 can be raised by exerting an upward force on the cable 5 or lowered by releasing the cable 5. The shape of the cam member 17 is such that in the position shown in Figures 1, 2, 5, 6 and 7, the dimensions from the axis of the shaft 15 to the lateral sides of the cam 17 and to the lower edge of the cam 17 are approximately the same, the dimensions 17*a* from the axis 15 to the upper edge of the cam is greater and a hardened spike 19 projects downwardly from the lower edge of the cam 17. If the cam 17 is rotated in a clockwise direction as viewed in Figures 2 and 6 from the position shown therein, the portion of the face of the cam having the increased dimension 17*a* will bear against one of the side walls of the guideway 18 and will force the hardened spike 19 into the opposite side wall of the guideway 18, that is to say the position shown in Figure 4 and in Figure 8 in which the guideway 18 is also shown.

A radial arm 20 is secured on the shaft 15 by a set screw 21. A torsion spring 22 has one of its ends bearing on the plate 3 and the other of its ends engaged behind the arm 20 so that the arm 20 and the shaft 15 are biassed for clockwise movement as viewed in Figure 2. At its upper end, the arm 20 has a reduced dimension portion 20*a* which, in the position shown in Figure 1, is located between the plate 3 and a gate lever 23, the gate lever 23 being pivoted by a vertical pin 24 on a bifurcated mounting 25 and being retained at its other end by a removable pin 26 which passes through a further bifurcated mounting 27 and through an aperture in the gate lever 23. A flexible wire 28 couples the upper end of the removable pin 26 to the loop 9 of the cable 5.

In the position shown in Figures 3 and 4, the cable 5 has failed at an upper position (not shown) and the force of the spring 10 has pulled the stop 8 a considerable distance away from the adjusting tube 7 which rests by means of its nut 7*a* on the tubular guide 5. Such movement of the stop 8 has caused the wire 28 to pull the removable pin 26 out of the bifurcated mount 27 and the force of the torsion spring 22 acting on the shaft 15 and the arm 20 has swung the gate lever 23 from the position of Figure 1 to release the arm 20 for clockwise movement, as viewed in Figure 4, which clockwise movement has caused the cam 17 with the hardened spike 19 thereon to jam in the guideway 18 thereby immediately arresting downwardly movement of the door 1. Preferably the door will be arrested before it has fallen more than 5 cm.

It will be noticed that the arm 20 is mounted adjacent the bifurcated mount 25 and a considerable distance from the bifurcated mount 27 thereby to reduce the force necessary to extract the removable pin 26. Preferably the pin 26 is spaced six times the distance the arm 20 is spaced from the pivot pin 24 and the force required to remove the pin 26 is advantageously in the region of 1.4 Newtons. The operation of the safety device can readily be checked by manually removing the pin 26 thereby to ensure that the gate lever 23 is free to swing, the spring 22 is not rusted through or otherwise broken and the shaft 15 is freely rotatable in the bearing supports 16.

Normally sectional overhead doors are provided with two cables, one at each side thereof, and it has been known for operators to continue using a door even after one cable thereof has broken. This obviously places extra strain on the remaining cable with consequent liability of immenent failure. With the safety device of the invention, the door will be locked in a position as soon as one or other of the cables break thus giving a clear indication that one of the cables has broken. It is however possible to over-ride the braking effect, after supporting the weight of the door, by returning the arm 20 it is

original position and locking it by inserting a further pin in the bifurcated mount 27 to secure the gate lever 23 in position. The door can then be jacked to a fully open position and again locked by removing the pin from the bifurcated mount 27 so that passage through the doorway can be obtained with the door held in a fully opened position until the broken cable can be replaced.

CLAIMS (filed 30-7-82)

1. A safety device, to brake closing movement of a sectional overhead door in the event of failure of a cable of counterbalance means for the door, comprising a cam member mounted on a shaft adjacent the lower end of the door and engaged in a guide track for the door, the shaft being spring biassed for rotation so as to rotate the cam member to cause it to bear against the guide track to brake closing movement of the door, an arm secured to the shaft and extending generally radially therefrom, securing means to retain the arm in a first position which corresponds to an inoperative position of the cam member and trip means to disable the securing means in the event of failure of the cable.

2. A safety device according to claim 1, in which the securing means comprises a gate lever pivoted at one of its ends on the door, extending across the path movement of the arm from said first position and retained at its other end by a sliding pin.

3. A safety device according to claim 2, in which, in the event of cable failure, the sliding pin is removed by the trip means and the gate lever pivots out of the path of the arm to allow the arm to move from said first position to rotate the cam member and cause it to brake movement of the door.

4. A safety lever according to claim 2 or claim 3, in which operation of the safety device can be tested by manually removing the sliding pin.

5. A safety device according to any one of claims 2 to 4, in which the trip means to remove the sliding pin upon cable failure comprises flexible means connecting the sliding pin to a stop provided at the end of the cable, which stop is biassed away from a guide for the cable by spring means so that, in the event of cable failure, the stop will move away from the guide and cause the flexible means to remove the sliding pin.

6. A safety device according to claim 5, in which the shaft extends through a lower pulley of the door, around which lower pulley the cable passes to extend through the guide to the stop.

7. A safety device, to brake closing movement of a sectional overhead door in the event of failure of a cable of counterbalance means for the door, substantially as hereinbefore described and illustrated with reference to the accompanying drawings.

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